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ABSTRACT

This research seeks to find the most effective mode of instruction which can assist undergraduate students in gaining initial computing skills while alleviating anxiety by contrasting a traditional direct teaching approach with one that emphasizes self-regulation within a cooperative learning context. Specifically, the study compares the motivation and anxiety levels of a selection of high and low anxious students in direct instruction and cooperative, self-regulated learning groups. It uses qualitative research techniques to describe and evaluate the effects of each program on motivation, anxiety, and learning, and it obtains feedback from students and instructor on the perceived strengths and weaknesses of each approach. Results indicate that for students undertaking computer skills courses, an instructional strategy which fosters the development of self-regulation and peer support reduces anxiety and increases motivation by enhancing a sense of control and competence. Appendices include a list of generic question stems, a list of interview questions, and a chart which assembles quotations and comments from the feedback. (Contains 22 references.) (Author/BEW)

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Students' attitudes towards cooperative, self-regulated learning versus teacher directed instruction in a computer training course: A qualitative study

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Abstract

This research examines the question of the most effective mode of instruction for assisting undergraduate students in gaining initial computing skills while alleviating anxiety by contrasting a traditional direct teaching approach with an approach which emphasises the development of self-regulation within a cooperative learning context. Specifically, the study compares the motivation and anxiety levels of a selection of high and low anxious students in the direct instruction and cooperative self-regulated learning groups; describes and evaluates the effects of each program on motivation, anxiety and learning using qualitative research techniques; and obtains feedback from students and instructor on the perceived strengths and weaknesses of each approach in the context of anxiety alleviation/exacerbation and the gaining of self-efficacy and self-regulated learning skills.

Qualitative analyses indicate that for students undertaking computer skills courses, an instructional strategy which fosters the development of self-regulation through metacognitive strategy training in higher order questioning, and which provides peer support within a collaborative learning environment, reduces anxiety and increases motivation by enhancing a sense of control and competence.

Objectives of the study

1. **Compare** the motivation and anxiety levels of a selection of students learning about computing through direct instruction alone with students learning about computing through a combination of direct instruction and cooperative, self-regulated learning which incorporated training in the metacognitive strategy of self-questioning.

2. **Describe and evaluate** an instructional program in operation using qualitative observational techniques (regular interviews with instructor and selected high and low computer anxious students, as well as monitoring of student and instructor logbooks). Particular areas of interest were instructor and student perceptions of advantages and disadvantages of each teaching model; the processes involved in gaining metacognitive and self-regulatory skills; and the practical implications of both designing computer instruction using each mode and of assessing student achievement.

3. **Obtain information** regarding these students' perceptions of the computer competency training they received in the context of anxiety alleviation/ exacerbation and the gaining of self-efficacy and self-regulated learning strategies.

Qualitative Analyses

"Qualitative data are attractive. They are a source of well grounded, rich descriptions and explanations of processes occurring in local contexts. With qualitative data one can preserve chronological flow, assess local causality, and derive fruitful explanations ...." (Miles & Huberman, 1994, p15).

There were two alternative "instructional packages" used by the same instructor with equivalent groups in the qualitative research. Students in each of the two groups received exactly the same computing content delivered by their instructor each week. Interspersed throughout each lecture, and at the conclusion of each tutorial, one group received practice in metacognitive strategies (asking higher order questions which prompt active construction of knowledge on the part of students). The other group received the direct instructional model of practice and review of material in addition to receiving individual assistance from the instructor, as required.

Furthermore, during pre-exam review periods, the metacognitive training group worked in structured, cooperative groups using reciprocal peer-questioning strategies which the instructor modelled and for which opportunities to practice the skills were provided. The other group used this period of review in the traditional, direct instructional way, practicing individually.

Weekly half-hour interviews of case-study subjects were conducted throughout the semester by a trained interviewer (senior graduate research assistant), experienced in interview techniques. Information was tape-recorded and transcribed by the interviewer. A summary of key points that specifically related to the focus of each of the interview questions was compiled.

A diary was kept by the instructor who taught the two groups which reported on the academic content covered (relative to the prepared content sheets that were developed in advance of each tutorial to ensure equivalence of coverage). This diary also reported observations of the groups' performances and attitudes relative to the two instructional methods used.

Student weekly logbooks entries were made following each week's tutorials by each of the case-study subjects.

Each of these sources of data were analysed in detail by the chief researcher.

Participants

Two equivalent groups of students completing compulsory computer coursework in the subject Introduction to Computers were randomly assigned to alternative modes of delivery taught by the same instructor. The classes were selected from the Faculty of Arts and Social Sciences at a regional university in NSW, Australia. One group (n=16, m=10, f=6) received computer "training" through direct instruction, and the other group (n=15, m=7, f=8) received "training" through direct instruction and the development of collaborative self-regulated learning strategies. The average age of the students was 20 years.

The selection of subjects for the qualitative case studies was as follows: Students who had the highest scores (above 3 i.e., moderate to high anxiety) on most of the scales of the Computer Learning and Anxiety Measure instrument (McInerney, McInerney, Lawson & Roche, 1994) were considered for selection as high anxious subjects. Conversely, those who scored 2 or below were considered as low anxious subjects. The four students in each of these groups with the highest scores were invited to participate in the research following a brief explanation of their commitment.

Results and Conclusions

Qualititative analyses indicated that even students who appeared low anxious on the psychometric survey demonstrated some levels of anxiety throughout the course depending on classroom circumstances, although the relative difference between the two levels of anxiety remained.

It is clear that students who are initially low anxious on the Computer Anxiety and Learning Measure, nevertheless, have some level of anxiety which may be described as a "good" stress which motivates and facilitates their learning (perhaps by sharpening their sense of control and self-efficacy perceptions), while those high in anxiety may suffer reduced motivation which can impede their learning. This is certainly indicated by the findings from the present research which show that where the factors causing anxiety may be debilitating for the highly anxious student in the direct instruction group, this is not the case in a cooperative learning setting where training is given in strategies of self-regulation and metacognition. It is feasible that training in such strategies provides for the highly anxious what "comes naturally" to the low anxious.

Two clear findings emerge from the case study interviews. The first is that previous experience with technology accounts for a considerable degree of motivation to learn computing, even for the initially anxious student. The second is that the formal learning of computing skills may contribute to anxiety reduction for only some students and that despite such experience, perceptions of control and a computing self-concept are not guaranteed. For example, Andrew (low anxious in the cooperative group) has the same level of prior learning of computers as Lisa (low anxious in the direct instruction group) - his sense of control and computing self-concept are very high while hers are very low at the start of the course.

Motivation and Anxiety Levels

● Sense of Control and Purpose Is Enhanced by Cooperation

Comments from initially anxious students revealed that there were a number of negative features of the direct instruction approach in terms of their motivation and anxiety. These related to their lack of perceived control over the content and its presentation: ***"Lapses in concentration are producing difficulties"*** is how one highly anxious male (Nathan) in the direct instruction group referred to the frustrations and anxiety created by the problems (i.e., ***"getting lost"***) he was having in the course. ***"The course ... becomes boring because too much information is presented; too overwhelming"*** is how an initially highly anxious female (Kylie) describes her motivation in this group.

● Groupwork Enhances Motivation and Dissipates Anxiety

For those in the cooperative group, motivation appears to be intrinsic. Computer anxiety is clearly dissipated by both collaboration and the regular practice of collaborating to discuss content-related higher order questions in groups. For example, as Michael (moderately anxious in the cooperative group) reports in his logbook, ***"Breaking up into groups was a good idea as it allowed us to communicate our thoughts and exchange ideas that we individually may not have thought of."***

As Michael also explains, in this class ***"The atmosphere was carefree and enthusiastic as everybody seemed to enjoy experimenting with graphs. That is what I feel there should be more of - self-learning - as people can learn by just experimenting with the computer commands."***

- **Reception Learning is Boring**

One gregarious, low anxious, male student (Terry) in the direct instruction group observed in his weekly logbook that his computing classes were boring and mechanical places to learn: ***"For some reason this class seems to remind me of the great secretarial typing pools of the 40s and 50s that you see in the movies, especially when we're all bashing away."***

Similarly, Lisa, another low anxious student in the direct instruction group reflects that ***"It was really dull today - my tutorial is so boring; we just sit there for two hours in front of the computer like puppets waiting to be told what to do next."***

- **Anxiety Depends on How Well Things are Going Under Teacher-Led Instruction**

As one highly anxious student in the direct instruction group comments, ***"When R. has written all the instructions on the board and we can do it at our own pace, things are much better, I don't get left behind. It was excellent to do things in your own time."*** However, when she falls behind the group because of difficulties, her ***"main worry is hurrying to catch up, being left behind; uneasy when everyone else's page was different .... when I used to make a mistake and correct it myself, R. would go on and I'd get left behind and get anxious."***

Perceptions of Advantages and Disadvantages of Each Teaching Model from Instructor's Perspective

● Level of Activity and Involvement Varies According to Teaching Method

When fostering cooperative groupwork there will be a degree of noise due to student talking and movement which may be disconcerting for students who are unfamiliar with such interaction. The instructor noted in her diary, however, that this noise decreased to quite a low level progressively throughout the course.

On the other hand, the instructor found that although it was very quiet in the direct instruction group - ***"This group is so quiet - you can hear a pin drop!"*** it was frustrating to teach them because of their lack of responsiveness: ***"What can I say? We finished early - no talking again, everyone typing and keeping up; no questions. Do they understand? ... This group is not used to contributing in class, and it is like extracting teeth to get them to answer a general question."***

It is clearly more rewarding for the instructor to facilitate the learning in the cooperative learning group: ***"The students appeared relaxed and the atmosphere was cheerful ... It was very satisfying to me to see how the students were working together and not referring to me all the time."***

● Instructor Time Commitment is Greater with Direct Teaching

Training (instructor modelling and student practice) in the use of higher order questions within tutorials requires considerable teacher preparation. Furthermore, pausing too often in a tutorial after content delivery and student practice of skills to ask higher order questions and to use these as review, is time-consuming and slows down content delivery. Particularly at the start of the course, this is because students are at different levels of keyboard proficiency - some have to wait and get bored; others become anxious because they are behind.

Direct instruction is also demanding for the instructor a lot of inexperienced and anxious students require help simultaneously: ***"I feel worn out after this class."***

● Attendance Problems are Related to Motivation and Commitment

There was a noticeably higher weekly attendance at tutorials throughout the course in the cooperative learning group than in the direct instruction group: ***"Absenteeism is very low in this group compared to the other group."*** This was related to the enthusiasm and commitment to each other shown by students in the former group: ***"Some of the students knew how to do the tasks and applied it to their work and then turned to the other students who needed help and advised them how to do it There was no prompting from me to do this. On more than one occasion I noticed that at one stage a particular student would know how to do the task and help someone else; on other occasions this was reversed."***

● Individual Differences Exist in Asking for Help

Some students in any group are embarrassed to ask the instructor for help: ***"I feel stupid asking R. the simple things"*** says a student in the direct instruction group. With teacher-directed instruction, students typically wait for individual attention and may get behind the rest of the class: ***"When I used to make a mistake and correct it myself R. would go on and I'd get left behind and get anxious ... I got behind the class - so far behind."***

Students' Perceptions of the Computer Competency Training they Received in the Context of Both Anxiety Alleviation or Exacerbation and the Gaining of Self-efficacy and Self-regulated Learning Skills

From the observations of the instructor, there was no doubt that the training in using generic question stems and the practice within cooperative group settings, assisted their review of procedural computing knowledge: ***"The cooperative learning group were able to answer questions much better and more quickly than the direct instruction group. A number of students in the direct instruction group were unable to answer, and were quite embarrassed about it, saying, 'I don't know.' A few in the cooperative learning group who could not answer the specific question I asked, said, 'I'm not sure, come back to me.' I felt encouraged by this as it showed they had higher self-confidence than the direct instruction group."***

● Reciprocal Questioning Develops Self-questioning Skills

Training in the use of higher order questions (generic question stems) facilitated learning for students in the cooperative learning group. As one highly anxious female (Yonneka) comments, ***"Posing my own question helped me to solve a problem with the rest of the class; groups asked questions that I wasn't sure of - so the class helped me find those out."***

Even for an experienced computer user like Andrew who finds it hard to work in groups in which other students are not as proficient as he, both practice in the use of question stems and groupwork are identified as beneficial for his learning: ***Thinking up questions is helpful because it forces you to think about what you don't understand ... helps you with ideas about what you might still have trouble with ... Groupwork helps everyone because if anyone doesn't know something, the others can help in the group or the whole class."***

● Helping is "Good For" All Learners

The environment of social support is frequently referred to by students in the cooperative self-regulated group. "Helping" is clearly a significant component of both effective learning and anxiety reduction, irrespective of initial level of anxiety or computer experience: ***"Asking people for help is much better; it's a lot quicker. If you get something wrong there's nothing wrong with saying 'I got it wrong'. "You should be able to ask for help; being embarrassed to ask for help ... that's what makes people more tense ... if you feel like you can't ask for help, like you're the only one doing it wrong then you'll be less likely to go along with the computer course"*** (Michael). As a consequence of the cooperative social processes within which he constructed his computing knowledge, at the end of the course, Michael, whose biggest fear was ***"saving and wiping information"***, reports that he feels ***"more in control now and much more comfortable with computers."***

● Structure is Reassuring for Some and Threatening for Others

The methodical, step-by step approach plus teacher supervision of skills practice mode of instruction adopted in the direct instruction group was found to be very reassuring for a female novice like Kylie who was highly anxious: ***"The most helpful part of the course is the instructions written on the board to be followed step-by-step, and Robyn coming around and checking."***

However, for one highly anxious, inexperienced, male student, the transmission approach created a great sense of isolation and frustration, sufficient for him to drop out of the course in the fourth week. As he reported after his second class that: ***"I was frustrated and lost because I had no idea what to do. The teacher is assuming knowledge. I can't handle it on my own ... I'm guessing how to do it ... The tutor or other students telling me what to do helps for the moment, but doesn't help me understand it for next time."*** Clearly, this student needs both metacognitive strategy training to develop a sense of control over his learning, and the social support of peers learning cooperatively together to allay his high anxiety. A similar comment was made by another male novice (highly anxious) early in the course: ***"Getting help from the teacher, with her doing it for you, doesn't feel like you're learning, just going through the motions to keep up."***

- **Students "Naturally" Tend to Help Each Other**

Even without structured groupwork, a number of students within the direct instruction group spontaneously formed collaborations to help one another. Typically, however, this was a grouping of those with the same level of proficiency with computers and of the same gender. As one student described it, ***"I talked to the guy next to me ...we were both making mistakes; that makes me feel better - it's not so bad then ... It was more fun this week, having someone next to me to muck around with; I'm not so nervous - I don't mind doing the work now ..."***

- **Learning Within a Social Setting Reduces Anxiety**

Structured cooperative groupwork is clearly a very powerful tool for alleviating anxiety: ***"The most helpful part of the course was the group work; I got input from others, you weren't put on the spot; .... there wasn't that feeling of competition when you were talking and helping each other. I liked the course, how it was set out - how Robyn set up the classes- the discussion in groups and the step-by-step learning - it was easy for someone who hadn't done it before."***

- **Structured Helping and Cognitive Interaction is Better than Spontaneous Collaboration**

From a fearful female: ***"There wasn't that feeling of competition when you were talking and helping each other";*** and from a competent male: ***"The class is more of a team - everyone helping each other; I'm not afraid to ask for help or to offer help - you get more ideas. I help people and they help me."***

- **Anxious Students Can Avoid Public Humiliation through Reciprocal Questioning**

The fear of public embarrassment is often a significant contributor to anxiety and can be aggravated in learning situations where students are called upon to answer questions aloud in a class, or where performance is "obvious" to others such as in computer classes where individuals can see each others' screens. As one extremely inexperienced female in the cooperative group remarked: ***"I don't like being asked to answer questions in class - it makes me nervous. I'm too afraid to say anything thta might be wrong ... Doind questions with a partner was good - it helped me relax ... The whole class had discussion questions to write and answer so I wasn't worried about whether the teacher would ask only me to answer."***

LOGBOOK FORMAT

Eight students (two high and two low anxious from each of the experimental and control groups) kept a LOGBOOK in which they recorded the following as soon as possible after each tutorial. This was the message to students about reporting in their logbooks:

PART A. Description of Each Computing Session

1. What your instructor taught.

2. What the student and others in your group did in the tutorial.

3. What happened with equipment (hardware and software).

4. Any other details that are a purely objective description (not your opinion) of what happened in the class time.

PART B. Impressions

1. What you feel you learned.

2. What you had difficulty with or did not understand.

3. What you felt before, during and after the tutorial (positive and negative).

4. What direction you think you might take on the basis of the experiences of the tutorial both in thoughts and actions. This can be referred to as an ACTION statement.

GENERIC QUESTION STEMS

1. What is the main idea of .... ?
2. What if .... ?
3. What is the meaning of .... ?
4. Why is .... important?
5. Explain why ....
6. Explain how ....
7. How does .... relate to what I've learned before?
8. What is the difference between .... and .... ?
9. How are .... and .... similar?
10. How would I use .... to .... ?
11. What is the best .... and why?
12. What are some possible solutions for the problem of .... ?
13. What would happen if .... ?
14. What do I still not understand about .... ?

(Adapted from King, A. (1992). Facilitating elaborative learning through guided student-generated questioning. Educational Psychologist, 27, 1, 111-126)

INTERVIEW QUESTIONS

1. What do you THINK about the course so far?
2. How do you FEEL about the course so far?
3. What did you LEARN in this week's class?
4. Do you like getting COMMENTS from the other students/the lecturer while you are working?
5. Can you see any DIFFERENCE IN YOUR ATTITUDES from previous tutorials?
6. How would you RATE YOURSELF on the skill that you have learned this week?
   * "Happy to show others how to do it." (Very capable)
   * "Can manage to do it on my own." (Just comfortable)
   * "Couldn't do it on my own." (Not mastered)
7. What did you have DIFFICULTY with this week?
8. Do you feel that you can HANDLE THIS DIFFICULTY on your own?.
9. What COULD YOU DO about this (difficulty)?
10. Where WILL YOU GO from here?

Excerpts from Instructor's Weekly Tutorial Diary: Study One

Tutorial content	Group dynamics	Implementation of instructional strategy	Problems	Positive outcomes
DOS				
(Co-op)	students put forward their ideas without prompting	students reminded to be creative in answers to questions	Melissa and Yonneka (hi anx) did not participate in class discussion	students relaxed; atmosphere cheerful
(Direct)	lot of prompting to get answers	some students needed constant help from tutor - "I seemed to be all over the room"	minimal communication between students; "very hard to extract any answers to my questions"	
WordPerfect				
(Co-op)	students like to talk to one another about what they are doing	students formed groups of three; discussion of questions with those had not previously sat with	Yonneka (hi anx) reluctant to contribute orally to group answers; lack of time to pause every 20 min in content delivery for questioning - poor keyboard skills for some causes delays	"few students consulted me with problems - seemed to work it out between themselves"
(Direct)	little student involvement	much less time taken to cover the content than for Co-op group	"I was all over the room assisting students who were lost"; "students in this group do not fully understand what they are doing - some seem a bit lost"	
DBase				
(Co-op)	"this group seems like a 'group' - they talk to and assist each other"	"all students made their own notes on the questions without prompting from me"; split into 5 groups who each worked on one question		"even the loners are joining in the discussion"; absenteeism is very low

Tutorial content	Group dynamics	Implementation of instructional strategy	Problems	Positive outcomes
DBase (Direct)	"this group is a group of individuals - very little contact with one another except for Nathan (hi anx case-study) who is the most animated student in the group - he would fit in well with the Co-op group"	"we finished early - no talking, everyone typing and keeping up, no questions! Do they understand?" students worked individually at their own pace from the overhead without any tutor input -"I walked and prompted if they were on the wrong track"	absenteeism high in this group	no talking; everyone keeping up; "this group is so quiet you can here a pin drop!"
Spreadsheet (Co-op)	more discussion between the students on the questions and higher noise level than usual; "several students have gained considerable confidence in recent weeks"; mutual helping between students as needed, without prompting from tutor	Lotus 123 is not "user friendly" - most of the tutorial was direct instruction (tute 1); students formed groups themselves and began working on revision questions (tute 2); tutorial was a mixture of direct teaching for new features and self-directed practice	program crashed - lost a lot of tutorial time; some content rushed and will need revision in next class (tute 1);	answers to questions showing some thought - (not the most obvious ones) Yonneka (hi anx) wanted to contribute answers for the first time (tute 2); "students discussed questions with each other across the room without speaking to me - this was good"; "very satisfying to me to see how the students were working together and not referring to me at all"
(Direct)	atmosphere is very quiet; a little communication occurs between some weak students and more competent ones who give help when asked	using direct instruction the tutorial content was covered in one hour - proceeded to the next week's tutorial	"I seem to be the focal point for help in this group, whereas in the Co-op group, I feel more in the background - they ask others or go ahead"	

Tutorial content	Group dynamics	Implementation of instructional strategy	Problems	Positive outcomes
Graphs (Co-op)	most students wanting to offer answers in discussion, even those previously anxious (e.g., Yonneka)	direct instruction used to introduce graphs, then students left to work out and practice how to apply the concept to other graphs - they used their notes and helped each other; generic questions stems handed out and their use in the review period explained - students would be in small groups which would remain constant for the two-week review; using the question stems, they would question each other and then offer one question per group for the class to discuss; students asked to take question stems home to prepare their own questions for the next tutorial		"this was an enjoyable class for me with a very cooperative atmosphere; there was a low level of noise throughout"
(Direct)	no talking in this group; most coped well - some were a bit lost	"students wait for me to come to them before they ask for help"	"I felt that I needed to give instructions to this group"	tutorial ran very smoothly - all work completed
Skills Review (Co-op)	"students consulted each other before asking me, calling across the room to offer advice or ask for help"	four self-chosen groups formed (*it is worth noting that all of the case-studies formed one group*); "each group seemed to have a leader who directed the discussion (no prompting from me)"; each group which posed a question provided the answer for the class; handouts with questions given out by tutor; students made their own notes on these without prompting		atmosphere very light-hearted
(Direct)	very quiet atmosphere; students put hands up to ask tutor how to complete tasks; still a group of individuals with little contact	review questions asked of students individually	"like extracting blood from a stone"; students not ready when their turn to give answers or spoke barely audibly; errors	group not a problem to teach - do everything asked of them

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